Prokaryotic Gene Regulation

* Main Idea
  + DNA- binding proteins in prokaryotes genes by controlling transcription
  + **Operon-** a group of genes that are regulated together
* The Lac Operon
  + In order to use lactose for food, bacterium must transport lactose across its cel. membrane and then break the bond between glucose and galactose.
* Promoters and Operators
  + **Operator-** also known as the “o” site, where a DNA-binding protein known as the *lac* can bind to DNA

Eukaryotic Gene Regulation

* Main Idea
  + The “TATA Box” binds a protein that helps position RNA polymerase by marking a point just before the beginning of a gene
* Transcription Factors
  + by binding DNA sequences in the regulatory regions of eukaryotic genes, transcription factors control the expression of those genes
* Cell Specialization
  + The big point in this is that all the genetic codes are different
  + Ex: liver and nerve cells have different patterns than each other
  + Complex gene regulation in eukaryotes is what makes specialization possible
* RNA Interference
  + An enzyme called the “dicer” cuts these double stranded loops into microRNA, each about 20 base pairs in length
  + **RNA interference-** Blocking gene expression by means of an miRNA silencing complex
  + RNA interference use to be thought to be rare, but is now known that it is found throughout the living world and plays a big rule in human development
* The Promise of RNAi Technology
  + The discovery of this gave researchers the ability to switch genes on and off at will, all they had to was insert double-stranded RNA into cell
  + Scientists believe that further development of this will lead to the ability to cure and help protect against some diseases.

Genetic Control of Development

* Main Idea
  + Gene control has a big part in the shaping of a multi-cellular organism
  + **Differentiation-** becoming specialized in the structure and function that happens in gene regulation
* Homeotic Genes
  + **Homeotic genes-**master control gene, regulates organs that develop in specific parts of the body
  + The American biologist Edward B Lewis was the first to show that a specific group of genes controls the identities body parts
* Homeobox and Hox Genes
  + **Homeobox genes-**code for transcription factors that activate other genes that are important in cell development and differentiation
  + **Hox genes-** a group of Homeobox genes, located side by side in a single cluster
  + Master controls genes are like switches that trigger particular patterns of development and differentiation in cells and tissues
* Environmental Influences
  + Metamorphosis is a well studied example of how organisms can modify gene expression in response to change in their environment
  + The speed of metamorphosis is determined by various environmental changes that are translated into hormonal changes.

Basics of Gene Regulation

* Process that cells and viruses use to regulate the way that the information in genes is turned into gene products
* The first discovered example of a gene regulation system was the lac operon, discovered by Jacques Monod
* Gene regulation is essential for viruses, prokaryotes and eukaryotes as it increases the versatility and adaptability of an organism by allowing the cell to express protein when needed.







